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Interoffice Memorandum

SHELL OIL COMPANY
 Environmental Affairs - HS&ES

JUNE 24, 1982

JUN 29 '82

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 WESTHOLLOW RESEARCH CENTER, SHELL DEVELOPMENT COMPANY

TO: C. G. WALLS, MANAGER, QUALITY ASSURANCE/ENVIRONMENTAL
 CONSERVATION, WOOD RIVER REFINERY, SHELL OIL COMPANY

SUBJECT: PIEZOMETER TEST DATA - WOOD RIVER REFINERY

AGS	HDM	JPR
RWF	JVS	WFG
WJD	EWS	MFJ
BMB		FTW
INB	WDS	
TAC	WJC	
RHD	CCS	

During August 25 to August 28, 1981, Mr. Robert Szentirmay, WRC Analytical, visited the Wood River Refinery in order to help in the sampling of twenty-four piezometers installed around the Solid Waste Disposal Basin. The purpose of the sampling was to screen the groundwater in the vicinity of the Solid Waste Disposal Basin for any contamination or contaminant plume that might be present as a result of past activities. After demonstrating sampling procedures on five piezometers, a small diameter well pump and bailing equipment were left at Wood River so that Wood River personnel could complete the sampling of all piezometers during September and October, 1981. Due to special instrument requirements, WRC Analytical was requested to analyze piezometer well samples for Total Organic Halogen (TOX) and chlorinated pesticides. The purpose of this memorandum will be to describe the groundwater sampling procedures used for the piezometers and to report WRC's analytical findings.

Gas chromatographic analysis with electron capture detection (GC/EC) of 23 piezometer samples and gas chromatography/mass spectrographic (GC/MS) analysis of four samples for chlorinated pesticides indicated that none of the priority pollutant pesticides were present above the detection limits of the methods used (1 ppb and 20 ppb, respectively). Analysis of all piezometer samples were also conducted for Total Organic Halogen (TOX) using the U.S. EPA RCRA Method (Method 866 in SW-846, Revision B, July, 1981). This method is quoted to have a detection limit of 5 ppb for TOX in drinking water type samples. However, a comparison of data between two laboratories indicated gross discrepancies. Due to this problem, the only conclusion that can be drawn from our initial set of data is that TOX levels for all groundwater samples were below 2 ppm.

Method of Sampling

During August 25 to August 28, Mr. Robert Szentirmay, WRC Analytical, was on-site at the Wood River Refinery to demonstrate the use of piezometer sampling equipment to Ms. Debbie Domino and Mr. Jesse Celis, Jr. During that time five of the two-inch diameter piezometer wells were sampled (12L,

12U, 11L, 11U, and 8L). Subsequently, the rest of the piezometer wells were sampled by Wood River personnel using the same equipment and procedures as described by WRC.

In order to purge the piezometers of stagnant water, water was pumped from each piezometer prior to sampling. Since the Wood River aquifer is a high water yielding aquifer, at least 10 well bore volumes of water was pumped from each piezometer prior to sampling. Using a 1-3/4-inch small diameter pneumatic well pump¹ this required from 1 to 2 hours' pumping at roughly one-half gallon per minute. The well pump was submerged just below the surface of the water table while pumping. There was no measureable difference in water table level after pumping. After pumping sampling was performed using either stainless steel or teflon bailers that were pre-cleaned for each piezometer use. The well pump was also cleaned prior to each well use. Water table level measurements were made with an Olympic Well Probe² (an electric sounder).

Figures 1 and 2 show field measurements taken of piezometer 8L and 11L well water as a function of pumping for Specific Conductivity, Temperature and pH. Although the changes in these parameters are small, they suggest that stagnant water was removed from the well bores after roughly 3 bore volumes of pumping. During bailer sampling, the initial 2 to 3 bails of samples were also discarded due to the presence of surface debris. In the case of piezometer 12, a sulfur odor and black particulate matter were noted in the initial 2 bore volumes of pumped water and in initial bailed water. This cleared on further water pumping and bailing. In addition, pump and bailer were occasionally smudged with a grease which Wood River personnel had mistakenly used to grease piezometer caps. Contamination affects from the grease to piezometer water samples is unknown.

Table 1 shows a comparison of field and laboratory measurements made for the five piezometers sampled August 25 through August 28. Any increase in pH and decrease in specific conductivity in laboratory measurements when compared to field measurements can be explained as resulting from CO₂ evolution and metals precipitation occurring in samples upon standing (storage). The formation of a red-brown precipitate in all groundwater samples upon standing was noted during the sampling of the five piezometers. The specific conductivity value of 140 μ mhos/cm reported for piezometer 12U in Table 1 is highly suspect. The large difference in specific conductivity of groundwater taken from two piezometers located at the same site (12L and 12U) is not expected.

Samples for TOX and pesticide analysis were placed on wet ice and were shipped to WRC via ice chests. All other analyses were performed by the Wood River Refinery Laboratory. These data were reported in a memorandum of October 16, 1981 from C. G. Walls, Quality Assurance/Environmental Conservation - Wood River to T. R. Williams, Environmental Conservation/Operations - Head Office (Attachment 1 to this memorandum).

¹Geofilter Small Diameter Well Pump, Leonard Mold-& Die Works, Inc.
960 West 48th Avenue, Denver, Colorado 80221

²ACTAT Corporation, 16603 Olympic View Road, N.W., Silverdale, Washington 98383

Samples for Total Organic Halogen (TOX) analysis were distributed by Mr. Robert Szentirmay, WRC Analytical to the WRC laboratory and to Spectrix Corporation³ (an independent Houston contract laboratory). For comparative purposes, five groundwater samples were analyzed in duplicate by both laboratories. This was done since the RCRA TOX method is a new method of unknown reliability on groundwater samples. Both laboratories used the only commercially available instrument (at that time) for this analysis, the Dohrman DX-20 TOX Analyzer. The method (Method 866 in SW-846) has been tested by the U.S. EPA on drinking water quality samples and was reported to have detection limits of 0.005 ppm (5 ppb or 5 µg/l). However, the data reported by both Spectrix and WRC for Wood River groundwater split samples were very inconsistent and not comparable. Results for these five groundwater samples differed by factors of from 2X to 60X for the same split sample when analyzed by the two different laboratories. An analysis of a set of three standards (0 to 100 ppb) by both laboratories indicated that both were within a factor of 2X of the true value. Therefore the discrepancies between the two laboratories were not resolved. We feel that it serves no useful purpose to report this data except to report that all values reported were less than 2 ppm TOX. Since the time of these analyses WRC has had to have its instrument repaired. Currently, the Dohrman DX-20 is operational and we hope to be ready for more real world groundwater samples for method testing shortly. We would also like to conduct a round-robin study to evaluate the method for groundwater analysis.

Wood River Refinery specifically requested that samples be screened for chlorinated pesticides. Since the TOX analyses were inconclusive, samples were analyzed at WRC for chlorinated pesticides and PCB's using gas chromatography with electron capture detection (GC/EC). U.S. EPA Method 608 for Pesticides and PCB's was used.⁴ This method screens samples for the following pesticides and PCB's:

- Aldrin
- a-BHC
- b-BHC
- d-BHC
- g-BHC
- Chlordane
- 4,4-DDD
- 4,4-DDE
- 4,4-DDT
- Dieldrin
- Endosulfan I
- Endosulfan II
- Endosulfan Sulfate
- Endrin
- Endrin Aldehyde
- Heptachlor
- Heptachlor Epoxide
- Toxaphene
- PCB-1016

³Spectrix Corporation, 7408 Fannin, Houston, Texas 77054

⁴Federal Register, Vol. 44, No. 233, Dec. 3, 1979, pp. 69501-69909

PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260

None of these compounds were detected in any piezometer groundwater samples above detection limits by the GC/EC method as applied (≤ 1 ppb). For four of the samples broad interfering peaks interfered with the analysis of one or more of four specific pesticides (lindane, dieldrin, DDE, and DDT). The source or nature of these peaks is unknown. Since the electron capture detector will also respond to non-chlorinated compounds, the interferences are not necessarily chlorinated hydrocarbons. Compounds from the grease contaminating some of the piezometers is one possibility. These four samples were sent to GC/MS and screened for these four pesticides. None of these pesticides were found above the GC/MS detection limits of 20 ppb. The TOX and pesticide data are summarized in Table 2.

If you have any questions or need any more analyses done, please contact Mr. Robert Szentirmay, WRC Analytical, at SSN 433-7684.


M. J. O'Neal

RS/bl

Attachments

cc: ~~_____ (OSP)~~

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TABLE 1

A COMPARISON OF FIELD AND LABORATORY MEASUREMENTS
FOR PIEZOMETERS, AUGUST, 1981

Piezometer Number	<u>FIELD MEASUREMENTS</u>			<u>WOOD RIVER REFINERY</u> <u>LABORATORY MEASUREMENTS</u>	
	Water Table Level (Below Top of Pipe) feet	pH	Specific Conductivity μ mhos/cm.	pH	Specific Conductivity μ mhos/cm
8L	47.29	7.1	2170	7.6	2125
11L	46.93	7.0	2200	8.2	1875
11U	47.46	7.2	2170	8.4	1850
12L	27.33	7.4	2080	7.1	1020
12U	28.94	7.4	2030	7.2	140

TABLE 2

RESULTS OF TOX AND PESTICIDES ANALYSES FOR
GROUNDWATER SAMPLES TAKEN FROM WOOD RIVER REFINERY PIEZOMETERS,
AUGUST - OCTOBER, 1981

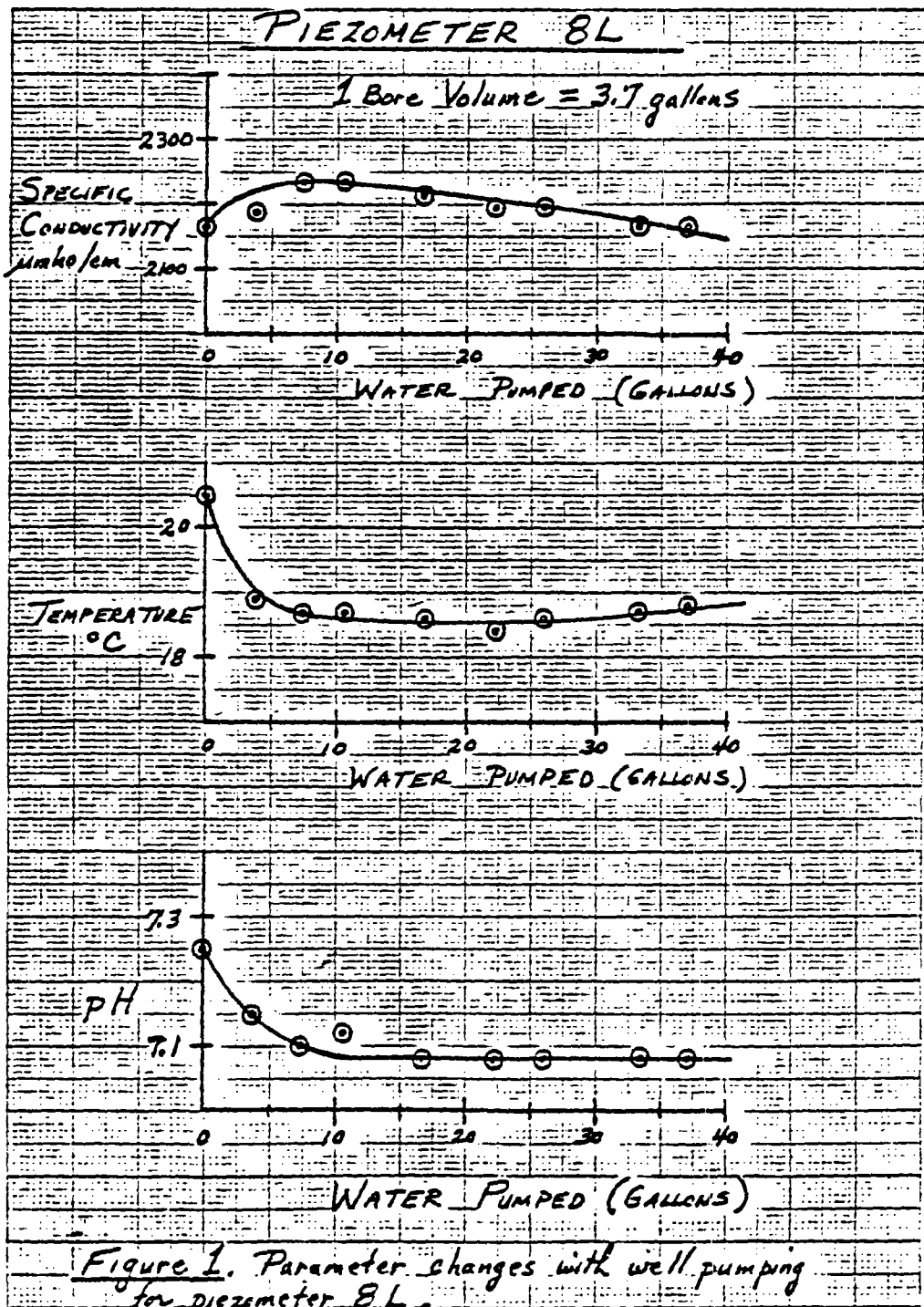
<u>Piezometer No.</u>	<u>TOX</u>	<u>Concentrations in ppm (mg/l)</u>
		<u>Chlorinated Pesticides</u>
1L	< 2	< 0.001
1U	< 2	< 0.001
2L	< 2	< 0.001
2U	< 2	< 0.001
3L	< 2	< 0.001
3U	< 2	< 0.001
4L	< 2	< 0.001
4U	< 2	< 0.001
5L	< 2	< 0.001 ^a
5U	< 2	< 0.001 ^b
6L	< 2	< 0.001 ^a
6U	< 2	< 0.001
7L	< 2	< 0.001
7U	< 2	< 0.001
8L	< 2	< 0.001
8U	< 2	< 0.001
9L	< 2	< 0.001
9U	< 2	< 0.001
10L	< 2	< 0.001
10U	< 2	< 0.001 ^c
11L	< 2	< 0.001 ^d
11U	< 2	< 0.001
12L	< 2	< 0.001
12U	< 2	< 0.001

a. GC/MS analysis for lindane and DDT ≤ 0.020 ppm.

b. GC/MS analysis for lindane ≤ 0.020 ppm.

c. GC/MS analysis for dieldrin and DDE ≤ 0.020 ppm.

d. Sample lost.



PIEZOMETER 11 L

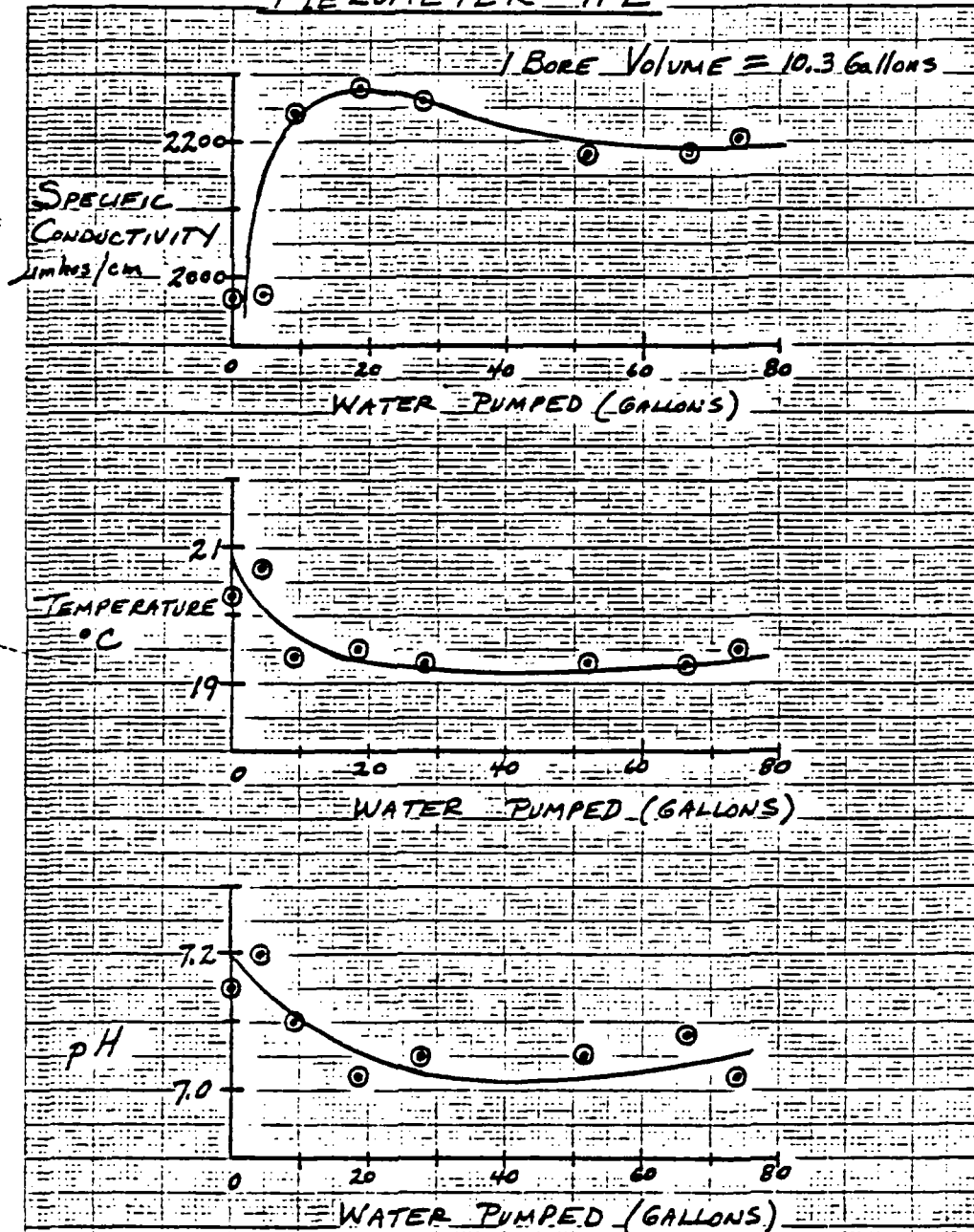


FIGURE 2. Parameter changes with well pumping for piezometer 11 L.